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Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China





NPN Silicon Switching Transistor

Qualified per MIL-PRF-19500/399

*Qualified Levels:
JAN, JANTX, and
JANTXV*

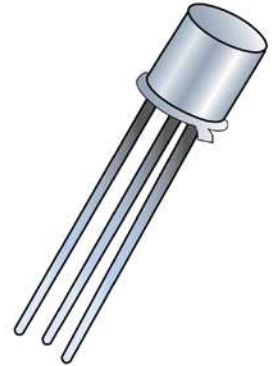
DESCRIPTION

This 2N3960 epitaxial planar transistor is military qualified up to the JANTXV level for high-reliability applications. It features a thru-hole TO-18 package. This device is also available in a low profile ceramic UB package.

Important: For the latest information, visit our website <http://www.microsemi.com>.

FEATURES

- Surface mount equivalent of JEDEC registered 2N3960 number
- JAN, JANTX, and JANTXV qualifications are available per MIL-PRF-19500/366. (See [part nomenclature](#) for all available options.)
- RoHS compliant versions available



**TO-18 (TO-206AA)
Package**

Also available in:

UB package
(surface mount)
 [2N3960UB](#)

APPLICATIONS / BENEFITS

- General purpose transistors for medium power applications requiring high frequency switching
- Leaded, hermetically sealed TO-18 package
- Lightweight
- Military and other high-reliability applications

MAXIMUM RATINGS @ T_C = +25 °C unless otherwise noted

| Parameters / Test Conditions | Symbol | Value | Unit |
|--|-----------------------------------|-------------|------|
| Junction & Storage Temperature Range | T _J , T _{stg} | -65 to +200 | °C |
| Collector-Emitter Voltage | V _{CEO} | 12 | V |
| Collector-Base Voltage | V _{CBO} | 20 | V |
| Emitter-Base Voltage | V _{EBO} | 4.5 | V |
| Total Power Dissipation @ T _A = +25 °C ⁽¹⁾ | P _T | 400 | mW |

Notes: 1. Derate linearly 2.3 mW/°C above T_A = +25 °C.

MSC – Lawrence

6 Lake Street,
Lawrence, MA 01841
Tel: 1-800-446-1158 or
(978) 620-2600
Fax: (978) 689-0803

MSC – Ireland

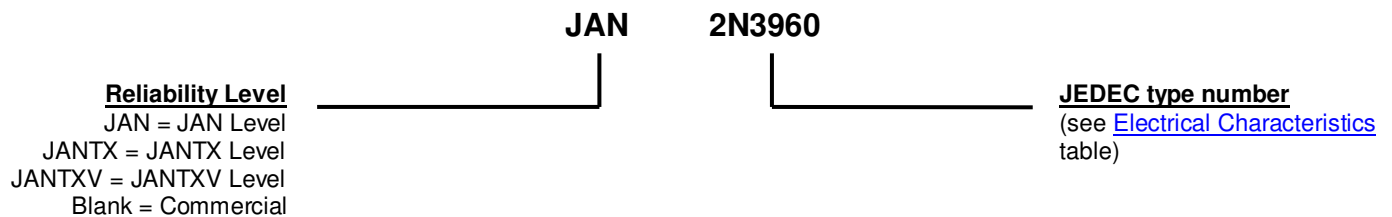
Gort Road Business Park,
Ennis, Co. Clare, Ireland
Tel: +353 (0) 65 6840044
Fax: +353 (0) 65 6822298

Website:

www.microsemi.com

MECHANICAL and PACKAGING

- CASE: Hermetically sealed, nickel plated kovar base, nickel cap
- TERMINALS: Kovar with Gold plate over nickel for JANS, plus solder dip for JAN, JANTX, and JANTXV
- MARKING: Part number, date code, manufacturer's ID
- WEIGHT: Approximately 0.3 grams
- See [Package Dimensions](#) on last page.

PART NOMENCLATURE

SYMBOLS & DEFINITIONS

| Symbol | Definition |
|-----------|---|
| I_B | Base current: The value of the dc current into the base terminal. |
| I_C | Collector current: The value of the dc current into the collector terminal. |
| V_{CB} | Collector-base voltage: The dc voltage between the collector and the base. |
| V_{CBO} | Collector-base voltage, base open: The voltage between the collector and base terminals when the emitter terminal is open-circuited. |
| V_{CE} | Collector-emitter voltage: The dc voltage between the collector and the emitter. |
| V_{CEO} | Collector-emitter voltage, base open: The voltage between the collector and the emitter terminals when the base terminal is open-circuited. |
| V_{CC} | Collector-supply voltage: The supply voltage applied to a circuit connected to the collector. |
| V_{EB} | Emitter-base voltage: The dc voltage between the emitter and the base |
| V_{EBO} | Emitter-base voltage, collector open: The voltage between the emitter and base terminals with the collector terminal open-circuited. |

ELECTRICAL CHARACTERISTICS @ $T_A = +25^\circ\text{C}$, unless otherwise noted

| Parameters / Test Conditions | Symbol | Min. | Max. | Unit |
|------------------------------|--------|------|------|------|
|------------------------------|--------|------|------|------|

OFF CHARACTERISTICS

| | | | | |
|--|--------------------------|----|--------|---------------------|
| Collector-Emitter Breakdown Voltage $I_C = 10\ \mu\text{A}$, pulsed | $V_{(BR)CEO}$ | 12 | | V |
| Collector-Base Cutoff Current $V_{CB} = 20\ \text{V}$ | I_{CBO} | | 10 | μA |
| Emitter-Base Cutoff Current $V_{EB} = 4.5\ \text{V}$ | I_{EBO} | | 10 | μA |
| Collector-Emitter Cutoff Current $V_{CE} = 10\ \text{V}$, $V_{EB} = 0.4\ \text{V}$ $V_{CE} = 10\ \text{V}$, $V_{EB} = 2.0\ \text{V}$ | I_{CEX1} I_{CEX2} | | 1 5 | μA nA |

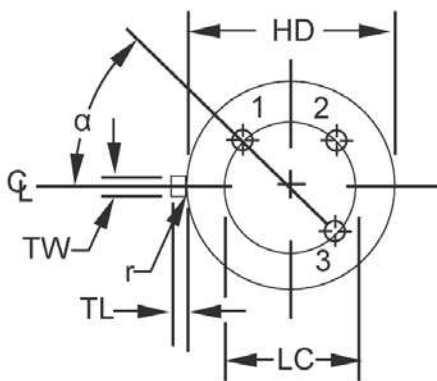
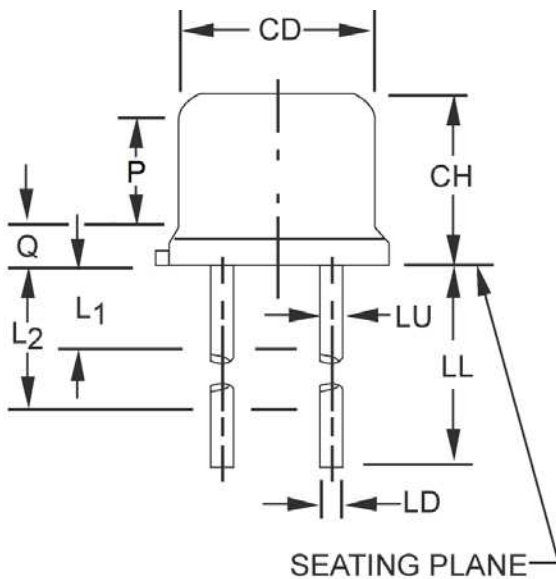
ON CHARACTERISTICS ⁽¹⁾

| | | | | |
|---|---------------|----------------|------------|---|
| Forward-Current Transfer Ratio $I_C = 1.0\ \text{mA}$, $V_{CE} = 1\ \text{V}$ $I_C = 10\ \text{mA}$, $V_{CE} = 1\ \text{V}$ $I_C = 30\ \text{mA}$, $V_{CE} = 1\ \text{V}$ | h_{FE} | 40 60 30 | 300 | |
| Collector-Emitter Saturation Voltage $I_C = 1.0\ \text{mA}$, $I_B = 0.1\ \text{mA}$ $I_C = 30\ \text{mA}$, $I_B = 3.0\ \text{mA}$ | $V_{CE(sat)}$ | | 0.2 0.3 | V |
| Base-Emitter Saturation Voltage $I_C = 1.0\ \text{mA}$, $V_{CE} = 1.0\ \text{V}$ $I_C = 30\ \text{mA}$, $V_{CE} = 1.0\ \text{V}$ | V_{BE} | | 0.8 1.0 | V |

DYNAMIC CHARACTERISTICS

| | | | | |
|--|------------|----------------|-----|----|
| Forward Current Transfer Ratio, Magnitude $I_C = 5.0\ \text{mA}$, $V_{CE} = 4\ \text{V}$, $f = 100\ \text{MHz}$ $I_C = 10\ \text{mA}$, $V_{CE} = 4\ \text{V}$, $f = 100\ \text{MHz}$ $I_C = 30\ \text{mA}$, $V_{CE} = 4\ \text{V}$, $f = 100\ \text{MHz}$ | $ h_{fe} $ | 13 14 12 | | |
| Output Capacitance $V_{CB} = 4\ \text{V}$, $I_E = 0$, $100\ \text{kHz} \leq f \leq 1\ \text{MHz}$ | C_{obo} | | 2.5 | pF |
| Input Capacitance $V_{EB} = 0.5\ \text{V}$, $I_C = 0$, $100\ \text{kHz} \leq f \leq 1.0\ \text{MHz}$ | C_{ibo} | | 2.5 | pF |

(1) Pulse Test: pulse width = $300\ \mu\text{s}$, duty cycle $\leq 2.0\%$

PACKAGE DIMENSIONS


| Symbol | Dimensions | | | | Note |
|-----------|------------|-------|-------------|-------|------|
| | Inch | | Millimeters | | |
| | Min | Max | Min | Max | |
| CD | 0.178 | 0.195 | 4.52 | 4.95 | |
| CH | 0.170 | 0.210 | 4.32 | 5.33 | |
| HD | 0.209 | 0.230 | 5.31 | 5.84 | |
| LC | 0.100 TP | | 2.54 TP | | 6 |
| LD | 0.016 | 0.021 | 0.41 | 0.53 | 7,11 |
| LL | 0.500 | 0.750 | 12.70 | 19.05 | 7 |
| LU | 0.016 | 0.019 | 0.41 | 0.48 | 12 |
| L1 | - | 0.050 | - | 1.27 | 7 |
| L2 | 0.250 | - | 6.35 | - | 7 |
| P | 0.100 | - | 2.54 | - | 5 |
| Q | - | 0.040 | - | 1.02 | 4 |
| TL | 0.028 | 0.048 | 0.71 | 1.22 | 3 |
| TW | 0.036 | 0.046 | 0.91 | 1.17 | 9 |
| r | - | 0.010 | - | 0.25 | 10 |
| α | 45° TP | | 45° TP | | 6 |

NOTES:

1. Dimensions are in inches.
2. Millimeters are given for information only.
3. Symbol TL is measured from HD maximum.
4. Details of outline in this zone are optional.
5. Symbol CD shall not vary more than 0.010 (0.25 mm) in zone P. This zone is controlled for automatic handling.
6. Leads at gauge plane 0.054 inch (1.37 mm) +.001 inch (0.03 mm) -0.000 inch (0.00 mm) below seating plane shall be within 0.007 inch (0.18 mm) radius of true position (TP) relative to tab. Device may be measured by direct methods or by gauge.
7. Symbol LD applies between L1 and L2. Dimension LD applies between L2 and LL minimum.
8. Lead number three is electrically connected to case.
9. Beyond r maximum, TW shall be held for a minimum length of 0.011 inch (0.28 mm).
10. Symbol r applied to both inside corners of tab.
11. Measured in a zone beyond 0.250 (6.35 mm) from the seating plane.
12. Measured in the zone between 0.050 (1.27 mm) and 0.250 (6.35 mm) from the seating plane.
13. In accordance with ASME Y14.5M, diameters are equivalent to ϕx symbology.
14. Lead 1 is emitter, lead 2 is base, and case is collector.